Project type: **NYS** IPM Special Project

Title **Determining the impact of an IPM educational effort to field crop producers**

Project Leader(s): J. Keith Waldron, NYS IPM Program, jkw5@cornell.edu

Cooperator(s): Yasamin Miller, Director, Survey Research Institute (SRI)**,** 168 Ives Hall, Cornell University, yd17@cornell.edu, 607-255-0148, www.sri.cornell.edu and Steven Ropel, Director, NYS Agriculture Statistics, Albany, NY, Stephen_Ropel@nass.usda.gov

Abstract: New York field crop producers were surveyed regarding use of field crop integrated pest management (IPM) practices through a collaboration between NYS IPM Program, Cornell's Survey Research Institute (SRI) and NYS Agricultural Statistics Service (NYS NASS). The project team created, implemented, and summarized the survey results regarding NY producer use of field crop IPM, insights into the impact of Cornell Cooperative Extension's educational efforts for field crop IPM and producer interest in specific environmental and pest management issues. The survey also provided insights into potential IPM adoption as affected by involvement with CCE and size of farm demographics.

Background and Justification: Three thousand New York (NY) field crop producers were surveyed in 1998 to assess their use of IPM practices, over 1000 provided feedback. That survey provided the first large-scale assessment of NY field crop IPM adoption. NY IPM personnel developed the survey with NY Agricultural Statistics Service professionals, who administered the instrument. This collaboration provided reliable data from a representative sample of over 8,000 NY field crop producers. Key findings documented that a fairly large percentage of producers were using at least *some* of the recommended pest management techniques. Results were encouraging and provided insights into areas of IPM strength and opportunities for improvement. In addition to data indicating use of specific IPM practices, further analysis of survey responses suggest growers with a closer affinity to CCE programs were more likely to exhibit higher IPM use than those not closely involved with CCE.

In the eight years since the original field crop IPM adoption survey, a number of factors have changed which potentially affect IPM implementation such as availability of new pest and pesticide resistant crops, impacts of FQPA, increased number of Certified Crop Advisors, more CCE IPM Trainings and the evolution of the internet as a significant source of information. For extension educators to keep pace with the potential impacts these changes may have on clientele, it is important to reassess the current state of field crop producer IPM use and knowledge. To address this need, a new updated field crop IPM adoption survey should be implemented. The data obtained in this new study will be instrumental in helping researchers, extension, and other agricultural industry professionals continue to effectively meet the needs of our stakeholders.

Objectives

The specific objectives of this study were to:

- document current New York State grower adoption of specific alfalfa and field corn IPM practices;
- document the effectiveness of Cooperative Extension IPM educational outreach designed to encourage field crop producers to adopt these IPM elements;
- document grower preferences regarding sources of technical information;
- identify grower concerns on key environmental issues;
- compare the results of this survey with the results from the survey conducted in 1998.

Methods

A survey instrument was developed to better understand and document the current integrated pest management practices used by New York (NY) field crop producers. The NYS IPM livestock and field crop IPM coordinator developed the questionnaire based on a previous field crop IPM adoption survey deployed in 1998. The revised questionnaire was reviewed by the Survey Research Institute (SRI) at Cornell University. SRI produced the final questionnaire in an electronically scannable form which could be administered to NY field crop producers. In addition, SRI was responsible for entering data from all completed questionnaires, analyzing the results, and comparing them with survey data collected in 1998. The New York field office of the National Agricultural Statistics Service (NASS) was responsible for selecting the alfalfa and field corn grower sample with a representative range of farm sizes and county representation. NASS personnel were also responsible for printing and mailing all surveys. Surveys were mailed to selected growers, with follow-up phone calls to non-respondents to encourage participation. All follow-up phone calls were conducted by NASS New York. Completed surveys were returned to the NASS New York field office, who did an initial evaluation of returned surveys for completeness, removed farm specific identification information. Surveys were then mailed to SRI for scanning, further processing and verification , data tabulation and analysis. Data analysis was performed using SPSS software.

Questionnaire Development

In 1998, the New York State Integrated Pest Management (IPM) program working with NY NASS developed and administered a survey to growers in NYS. The SRI assisted the NYS IPM team with a revision of that original questionnaire, with the intent to compare results from the two years as much as possible. As a result, many items remained the same as in the 1998 survey.

Sampling

The actual sample was drawn and provided by New York NASS. There were 365 respondents out of 800 surveys mailed. There were also 20 blank surveys returned and 27 who returned their survey form, but refused to answer any questions. These are not included in the data analysis. The surveys were administered by the New York NASS field office of the United States Department of Agriculture.

Response Outcome: completed full survey 365 (45.6%), did not complete 435 (54.4%), total 800 (100%)

Data Analysis:

Structure of the Survey Data

The administration of the survey was a scannable form. Most of questions asked the respondent to select all the choices that applied, yielding a series of yes/no answers. The survey was conducted in four parts. Section 1 contained questions to document the demographics of the respondent including crops grown, relative farm size, acreage and a self-assessment as to their experience and involvement in Cornell Cooperative Extension (CCE) programs. Section 2 posed general questions about the respondent's Integrated Pest Management (IPM) practices. Section 3 asked more specific questions on how the grower deals with field corn pests. Section 4 asked specific questions about the respondent's pest management practices with respect to alfalfa. Much of the 1998 survey was preserved to permit comparison of responses across the two time periods.

2007 Data Analysis

SRI analyzed the data using frequency tables categorized largely by farm size. Each of the tables replicate these produced in 1998.

Comparison with 1998 data

In addition to replicating the 1998 tables, SRI also looked at whether there were significant differences in the data collected in 1998 (N=1075) from the data collected in 2007. The complete data analysis was completed in an excel spreadsheet. Only those variables where statistically significant differences in results were determined across the two years are reported. Using a two-tailed test, any p-value less than or equal to .05 is considered statistically significant. A chi-square test for independence evaluates statistically significant differences between proportions for two or more groups in a data set. That is, if the p-value is less than or equal to .05, there is a significant difference between the 1998 and the 2007 percentages. Statistically significant differences are reported with an asterisk. For the question about environmental and pest management issues, a paired sample test was performed to compare the 1998 and 2007.

Results.

A complete summary of survey results was created by the Survey Research Institute in April 2007. An executive summary of those results follows.

General Characteristics of Surveyed Farms:

Total number of surveys completed: 365 (45.6% response rate)
Average farm size: 335 acres

Number by farm size: 106 small farms (99 acres or less) or 29%
126 farms of 100 to 249 acres or 34.5%
53 farms of 250 to 499 acres or 14.5%
38 farms of 500 to 999 acres or 10.4%
24 farms of greater than 1000 acres or 6.6%

Average crop acreage: 81 silage corn
88 grain corn

25 clear alfalfa
79 alfalfa grass mixture
22 new alfalfa seedings

Average number of cows: 123 (with farms having as many as 2400 cows, with one-quarter of respondents stating that they do not have any cows).

Two hundred ninety-one of 365 respondents indicated their level of involvement with CCE educational programs. Fifty-nine percent (172) of those responding had not been involved with CCE or IPM Training, eleven percent (33) had contact with CCE but had not participated in an IPM educational program, nearly 30% (86) had been a participant in a CCE IPM program with six percent (17) of those participants in a CCE TAg team. The 30% CCE IPM program participant level determined in the 2007 survey was significantly larger than the 9% level of involvement observed in the 1998 survey.

IPM Practices:

- Most respondents (N=259) had not participated in a Cornell Cooperative Extension IPM program. Of the several programs the survey asked about, Water Quality Protection Projects were slightly more popular (N=29) than others. For example, 20 respondents cited that they attended an IPM scouting/implementation demonstration. When comparing 1998 and 2007 data, there was a significant increase (p-value < .001) in the number of participants in a CCE IPM program;
- Most respondents (N=254 or 80%) test their soil at least every three years. Those who have larger farms were more likely (all 23 respondents that answered this questions) to soil test than those with smaller acreage. Thirty-eight percent of small farms responding (N=37) did not test their soil.
- Although almost 40% of respondents do not keep written field records, 33.2% keep field records for pesticide applications and 30.7% keep field records for crop variety. Only 10.7% of respondents keep field records for pest levels. There was a statistical significant decrease (p-value < .025) in number of respondents keeping field records when comparing 1998 and 2007 data. Of those that kept written field records, the only reason respondents cited that was statistically significant was for those that used written reports for tracking crop yields (p-value < .05).
- Although a majority of all respondents (52.9%) stated they use pesticides on their farms, three-quarters of small farms (99 acres or less) did not use pesticides. There was a significant decrease in number of respondents stating they used pesticides in 2007 vs. 1998 (p-value < .01).
- The frequency of calibration of pesticide application equipment varied widely depending on farm size and type of equipment. For example, a little more than 25% of respondents calibrated fertilizer equipment once a season. By contrast, over 41% (N=150) of respondents never calibrated their manure spreader, while under 20% (N=72) of respondents calibrate pesticide sprayers once a season.
- Respondents obtain pest management information from a wide variety of sources. There is no single source of information which farmers rely upon for pest management knowledge although pesticide dealers and CCE were the most popular. The majority of respondents obtain pest management information from pesticide dealers (41%) and CCE (28%). Comparing the 1998 and 2007, there is a statistically

significant decrease in those using trade journals (p-value < .025) and using other growers for pest management advice (p-value < .025), but a significant increase in use of the Internet (p-value < .001).

- Respondents report that they have a high level of concern about food safety (mean of 4.33 out of 5), government regulations (mean of 4.17) and pesticide effects on groundwater (mean of 4.06) and less concern about availability of IPM consultants (mean of 2.62) and time needed for IPM crop monitoring (mean of 2.67). Comparing 1998 and 2007, a number of variables showed significant differences in the values for *insecticide resistant pests* (p-value <.001)*, pesticide effects on ground water* (p-value < .001)*, government regulations* (p-value < .001)*, cost of crop monitoring* (p-value < .01) and *food safety issues* (p-value < .01).

Field Corn

- 73.9% of respondents reported they monitor field corn for insect, disease and weed problems.
  - About two-thirds monitor field corn for pest problems themselves.
  - A majority (58.7%) stated they monitor for problems two or three times during the growing season.
- Few respondents (13.2%) reported using field maps to aid weed management decisions. Of those that use field maps, most use them to adjust crop rotation sequence (about 45%), for refining herbicide choice and making post-emergent treatment decisions (each about 41%). Comparing 1998 and 2007 data, there is a statistically significant decline in use of weed maps for pest management (p-value < .001). Those reasons that are significantly different between the two surveys are using weed maps to refine herbicide choices (p-value < .05) and identifying potential herbicide resistant weeds (p-value < .05).
- A large proportion of respondents (85%) report rotating crops, and they do so with varying amounts of crop rotation. Two-thirds rotate less than 50% of their crops, while one-third rotate more 50% of their crops. There is no one reason for doing this rotation. There was a significant difference in percentage of respondents who rotated corn fields (p-value < .001) when analyzing the data obtained in 1998 and 2007.
- Only 12% of respondents use PSNT (pre-sidedress nitrogen testing) tests on their farms. Of those that do, exactly one-half of the respondents do so on over 50% (N=15) of the acreage and 50% use PSNT on less than 50% of their farm.
- Three-fifths of respondents indicated they take plant population counts.
- Respondents report concern over a variety of pests that could negatively affect their crops (the respondent was permitted to mark more than one). For example, almost 42% cited both annual broadleaf weeds (N=153) and annual grass weeds (N=152) as major pest concerns for the corn crop. Corn rootworm was cited by 149 respondents (40.8%). Foliar disease, however, was cited by only 25 respondents (6.8%) of respondents. There was a significant decrease in the percentage of respondents who cited pest concerns for corn crops (p-value < .025) between 1998 and 2007.
- A majority (55%) do not use planter box insecticide or fungicide treatments, although larger farms, were more likely to use them. Just over 61% of respondents use manufacturer applied seed coatings. These seed treatments were used for seed corn maggot, corn rootworm and wireworm.

- Respondents indicated they use a large variety of criteria on which to base field corn pest management decisions (they could mark more than one choice). For weed management criteria, most (41.1%) base decisions on previous weed problems, while using university guidelines (10.4%) was the least popular option. Chemical dealer advice was the most popular source of information for cutworm management (cited by 44 respondents and 12.1%). Personal threshold (N=10 and 2.7%) and university guidelines (N=11 and 3%) were the least cited. University guidelines were not widely used (N=16, 4.4%) for corn rootworm criteria either, but the previous presence of pest problems is widely cited (N=84, 23%). There was a statistically significant decrease in the percentage of respondents who cited criteria for weeds (p-value < .05) and criteria for rootworm (p-value < .05) between 1998 and 2007.
- A number of corn hybrids are resistant to certain insects and diseases and herbicides. All but two of the largest farms used some sort of a bioengineered variety of corn to combat rootworm, European corn borer, or are herbicide resistant. The majority of farms less than 1000 acres, did not use bioengineered varieties (N=61, 27% of all respondents).

Alfalfa

- A little more than a majority (54%) of respondents do not monitor their alfalfa crops for problems. The percentage that monitors their alfalfa goes up as farm size increases. Two-thirds of the smallest farms do not monitor crops for problems, while 75% of the largest farms do. Farm operators were the largest group that monitor for problems. Almost three-fifths of respondents monitor alfalfa two to three times a season. In comparing the 1998 and 2007 data, there is a significant increase in the percentage of respondents that monitor alfalfa 2 to 3 times a growing season (p-value < .05), but a significant decrease in those that monitored alfalfa more than 4 times during a growing season (p-value < .05) and during pest outbreaks (p-value < .05).
- Almost 90% do not use weed maps for their alfalfa crops. For those that do, 19 report they use weed maps for weed management, 13 use weed maps for variety selection, 12 for disease resistance mapping, 13 for manure application and 20 use them to enhance for crop rotation decisions. In comparing the 1998 and 2007 values, there is a significant decrease in the number of respondents making written maps for their alfalfa crops (p-value < .025).
- Over three-quarters report not using alfalfa crown counts. In comparing 1998 and 2007 data, there is a statistically significant fewer respondents use this alfalfa stand evaluation technique (p-value < .025).
- Potato leafhopper (N=129 and 35.3%) and alfalfa weevil (N=112 and 30.7%) are the main insect concerns for NY alfalfa producers. However, other pests such as annual broadleaf weeds (N=85 and 23.3%) and perennial grass weeds (N=88 and 24.1%) are also of concern. Foliar diseases (N=11 and 3%) are of least concern to respondents. Weevil criteria is determined mainly by crop appearance (N=54, 14.8%) and chemical dealer advice (N=47, 12.9%). Routine insecticide use (N=9, 2.5%) and university guidelines (N=10, 2.7%) were the least commonly cited criteria. Criteria for potato leafhoppers tend to be concentrated around crop appearance (N=67, 18.4%) and crop monitoring (N=60, 16.4%) and not university guidelines (N=9, 2.5%). For disease criteria, crop appearance (N=47, 12.9%), chemical dealer advice (N=45,

12.3%) and crop rotation sequence (N=44, 12.1%) were the most popular ways to ascertain criteria, while university guidelines (N=14, 3.8%) and routine (N=9, 2.5%) are the least popular amongst respondents.

- Farmers base their alfalfa pest management decisions on a number of criteria. For weed management, crop appearance (N=99, 27.1%), crop rotation sequence (N=97, 26.6%) and past pest problems (N=90, 24.7%) are the most popular criteria cited, whereas university guidelines is the least popular (N=19, 5.2%).
- Rotating crops (N=153, 41.9%) and harvesting earlier than planned to avoid insects, diseases and weeds (N=137, 37.5%), are the most commonly cited ways pests are controlled. Treating farms with a pesticide to control disease was a noticeably unpopular choice, cited by on 19 respondents (5.2%).

Adoption of Field Corn and Alfalfa IPM:

Indications of adoption of IPM can be drawn from grower use of particular IPM practices identified in the survey questions. Practices were assigned a relative point value with higher values given to certain "essential elements" such as crop monitoring, records keeping, use of thresholds, etc. This system allows for grower flexibility in the selection of IPM practices that are best suited for an individual farm. IPM Elements for field corn and alfalfa used in this study are shown in table 1. More information about "IPM Elements" can be found on the NYS IPM web site: www.nysipm.cornell.edu/elements/

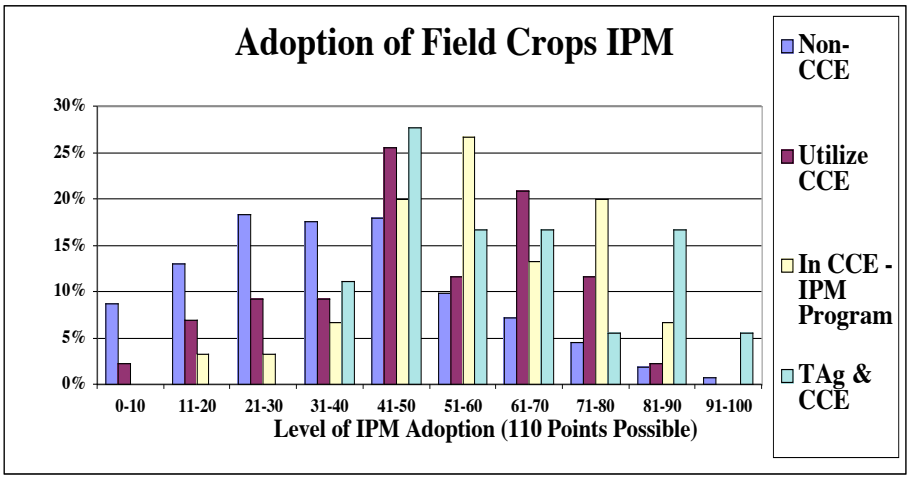
Respondents self-identified their involvement with Cornell Cooperative Extension programs allowing a comparison between those who had never been involved in a CCE program, those who obtained information from CCE but had not participated in an CCE sponsored IPM effort, those who may have been involved in an alfalfa or field corn IPM pilot program and finally those who were involved in a Tactical Agriculture Program (a more intensive experiential learning educational effort). Analysis of 1998 IPM use survey data indicated an association between increasing involvement of the respondent with CCE and their increasing level of adoption of recommended IPM practices. TAg participants had the highest level of IPM adoption indicators (figure 1). The maximum possible for utilizing all IPM and ICM practices identified in this survey are 110 points. Respondents not associated with Cornell Cooperative Extension (CCE) Programs averaged 36.6 points, respondents who utilize CCE but were not enrolled in an intensive IPM training program averaged 53.8 points, and those respondents who were a participant in an intensive CCE IPM Educational Program (Tactical Agricultural Teams - TAg) averaged 61.2 points.

Table 1. Integrated pest management practices for alfalfa and field corn: selected indicators of IPM Use and Adoption

General IPM Practices	**Points**
Test soil for fertilizer and pH recommendations?	
Every year	10
Every 2 years	7
Every 3 years	5
More than 3 years	1
Keep written field records?	
Pest levels	2

Pesticide Applications	2
Cultural pest management practices (planting date, rotation, harvest, etc.)	2
Crop variety or hybrid	2
Crop yields	2
Calibrate pesticide and fertilizer applic. equip, sprayers and granular boxes?	
Pesticide sprayer (once a season)	10
Pesticide planter box (once a season)	10
FIELD CORN (SELECTED IPM PRACTICES)	
Monitor corn fields for pests?	
Once a week	10
Two or three times during growing season	3
Four or more times during growing season	5
During specific pest outbreaks	1
Make spring or fall weed inventories, or written map of fields used in weed management decisions?	10
Review weed maps (of each field) before planting for the purpose of:	
Timing cultivation and/or rotary hoeing	1
Refining herbicide choice and selection	1
Evaluating pre-emergence herbicide program	1
Making post emergent treatment decisions	1
Identifying potential herbicide resistant weeds	1
Adjusting crop rotation sequence	1
Rotate corn fields, i.e., plant only in fields where sweet or field corn was not planted the previous year?	10
Conduct Pre-sidedress nitrogen testing (PSNT) to decide if additional sidedress nitrogen is needed?	3
Take plant population counts to evaluate stand establishment	3
ALFALFA (SELECTED IPM PRACTICES)	
Monitor alfalfa fields for pests?	
Once a week	10
Two or three times during the growing season	3
Four or more times during the growing season	5
During specific pest outbreaks	1
Make written maps of fields to use in evaluating crop condition, and pest (insect, weed and disease) status?	10
Take alfalfa crown counts to assess potential productivity of stands	3
Harvest field earlier than planned to avoid further damage by:	
alfalfa weevil	3
potato leafhopper	2
Total Maximum Points for General IPM	**40**
Total Maximum Points for Corn	**42**
Total Maximum Points for Alfalfa	**28**
Total Maximum Points for both crops and general	**110**

Figure 1. Adoption of Field Crop IPM – 1998 Survey



2007 data appears to indicate this trend continues although the overall level of adoption indicators was somewhat less than previously observed (Figure 2). Thirty-four percent of respondents not associated with CCE had the lowest level of IPM adoption indicators (0-10 points), while forty-one percent of TAg participants tallied 41-50 points. The highest overall number of points (81-90) were earned by respondents participating in a CCE sponsored IPM educational program.

Figure 2. Adoption of Field Crop IPM – 2007 Survey